Stormy Weather: *Race*, Gene Expression, and the Science of Health Disparities

In the current US political climate, conservative foundations are seeking to frame debates over determinants of racial/ethnic health disparities as a matter of "politically correct" unscientific ideology (concerning the health impacts of discrimination) vs scientific yet "politically incorrect" expertise rooted in biological facts (concerning genes).

I draw on historical and contemporary examples to place conservative polemics in context, and also highlight fundamental flaws in their arguments involving the use of spurious categories (e.g., *Caucasian*), logical fallacies, temporal fallacies, and an erroneous emphasis on gene frequency over gene expression. The larger goal is to strengthen development of a more critical, reflexive, and rigorous science capable of generating evidence useful for rectifying—rather than perpetuating—social disparities in health. (*Am J Public Health.* 2005;95:2155–2160. doi:10.2105/AJPH.2005.067108)

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ONE WORD APTLY DESCRIBES the state of contemporary discourse on race, genetics, and health disparities in the United States: stormy. As indicated recently in several major journals—in both special issues[1–4] and individual articles[5–11]—debate is thick and furious over whether *race* is a biological or social construct, and also whether racial/ethnic disparities in health are due to (a) innate genetic differences, (b) the biological impact of present and past histories of racial discrimination and economic deprivation, or (c) both.[12,13]

Why the word "stormy"? Because metaphor can usefully illuminate connections that might otherwise be missed.[14–17] Storms, after all, are violent disturbances of the atmosphere resulting from the movement and collision of masses of warmer and cooler air.[18] Arguments in turn are often polemically portrayed as a matter of "hot air" and impassioned beliefs vs "cool reason" and scientific logic.[16] Attesting to the "political climate" of our times, politically and economically conservative foundations within the United States (e.g., the American Enterprise Institute, the Manhattan Institute, and the Hoover Institute) are funding and promoting work seeking to frame debates over *race*, genetics, and health disparities as a matter of "politically correct" unscientific ideology vs scientific yet "politically incorrect" expertise rooted in biological facts.[19–24]

The notion, however, that scientific thinking and work must somehow "choose" between social justice and biology is itself an ideological stance—one that has surfaced repeatedly in US and European debates about human inequalities and health disparities over the past 2 centuries.[12,14,25–28] In light of conservative claims that theirs in the only "expert" approach, I draw on historical and contemporary examples to place their polemics in context. At issue are fundamental flaws involving the use of spurious categories (e.g., *Caucasian*), logical fallacies, temporal fallacies, and an erroneous emphasis on gene frequency over gene expression. Guiding my critique is ecosocial theory and its concern with both the biological embodiment of social inequality and the agency and accountability of scientists for the frameworks we employ.[14,29,30] The larger goal is to strengthen development of a more critical, reflexive, and rigorous science capable of generating evidence useful for rectifying—rather than perpetuating—social disparities in health.

"POLITICALLY CORRECT"? HOW ABOUT "CAUCASIAN"?

To begin, consider the oft-used and ostensibly scientific category "Caucasian," which in the US National Library of Medicine's MedlinePlus is defined as "of or relating to the White race of humankind as classified according to physical features."[31] In the first 2 months of 2005 alone, it appeared in the title or abstract of 257 articles indexed by the library's PubMed (a scientific citation index), on topics as varied as birthweight, health behavior, psoriasis, diabetes, mental health, cancer, and cardiovascular disease.[32] The term *Caucasian* likewise features prominently in work promoting BiDil, a drug intended for heart disease in African Americans[5,19] and the first of possibly many "ethnic/race-specific drugs."

On what basis, however, has *Caucasian* entered the scientific lexicon? Is it truly an objective factual term? A review of its actual etymology quickly reveals it is anything but.

In brief, the term *Caucasian* was coined in the 18th century by Johann Friedrich Blumenbach (1752–1840), for what became one of the world's most influential racial typologies.[33–36] In his 1775 opus *On the Natural Variety of Mankind*,[33(pp65–145)] Blumenbach reported data on skeletal traits and bodily characteristics of people worldwide to answer the question: "*Are men, and have the men of all times and of every race been of one and the same, or clearly of more than one species* [italics in original]?"[36(pp97,98)] Framing his work was the then-prevalent pre-Darwinian assumption that "variation" in humans, as in other animals, represented "degeneration" from a basic "type," as brought about by climate and other external influences.[28,35,36(pp196–200)]

On the basis of his analyses, Blumenbach arrived at 4 major conclusions:

1. All humans belong to 1 species, with equal human capacities to think, feel, and act.
2. "Caucasians" constitute the "primeval" human type from which all other varieties have diverged.
3. The "*[i]nnumerable varieties of mankind run into each other by insensible degrees* [italics in original]."[33(p264)]
4. While any division of these varieties is "arbitrary," humankind "may best, according to natural truth, be divided into the five following varieties; which may be designated and distinguished from each other by the names Caucasian, Mongolian, Ethiopian, American, and the Malay."[33(p264)]

These varieties arose, he hypothesized, because Caucasians, the original humans, "degenerated," in his words, into "Mongolian," by way of the intermediate "American" variety, and also into "Ethiopian," by way of the "Malay" variety[33(pp264–266)]—a hypothesis that notably is the complete reverse of contemporary scientific research indicating that *Homo sapiens* originated in the African continent.[2,4]

Why, however, the term *Caucasian*? As cogently argued by several contemporary scholars, but rarely noted in the public health or biomedical literature, answers lie at the crossroads of national politics, religious beliefs, racial aesthetics, and sexual desire.[37,38] In brief, the region of the Caucasus (located between the Black Sea and the Caspian Sea, abutting Europe, Asia, and the Middle East) provided a "safe" place on which to project back a common European ancestry without getting embroiled in volatile nationalist politics.[37] In the late 18th century, the Caucasus region, then under Russian rule, was relatively unknown to Western Europeans. At the same time, it was literally legendary. In Greek myths, it was where Zeus seduced Europa, Jason sought the Golden Fleece, the Amazons roamed, and the Greek gods chained Prometheus to a mountain peak as punishment for giving humanity fire.[37,39] From a Judeo-Christian perspective, it was home to Mount Ararat—of biblical fame for being the peak on which Noah's ark rested to survive the Deluge.[37] Hence the appeal of the term *Caucasian*: a politically palatable name with a rich legacy, free of the stamp of "nationality," and with all of the allure of a new scientific taxonomic term.

Equally revealing is the reason Blumenbach himself gave for his choice: "beauty." He wrote: "I have taken the name of this variety from Mount Caucasus, both because its neighbourhood, and especially its southern slope, produce the most beautiful race of men, I mean the Georgian."[33(p269)] As supporting evidence, he included the following footnote that focuses on the beauty of Georgian women, then especially prized by persons engaged in White slavery as a prime catch for harems and sexual services[38(p131)]:

> From a cloud of eye witnesses it is enough to quote one classical one, Jo. Chardin. . . . "The blood of Georgia is the best of the East, and perhaps in the world. I have not observed a single ugly face in that country, in either sex; but I have seen angelical ones. Nature there has lavished upon the women beauties which are not to be seen elsewhere. I consider it to be impossible to look at them without loving them. It would be impossible to paint more charming visages, or better figures, than those of the Georgians."[33(p269)]

On this basis, *Caucasian* became a scientific term.

Of note, Blumenbach's terminology was quickly taken up by his scientific peers, both those who shared his views on human equality (tempered by a partiality to *Caucasian* beauty) and those who did not.[27,28,34,35,40,41] By the time the British Anthropological Society published a special edition of Blumenbach's collected writings in 1865,[33] which commemorated his role as a key founder of the discipline of anthropology, the more malleable term *varieties* was replaced by more rigid term *race*, which in turn was tightly bound to concepts of inequality. In the preface to this volume, the editor posed what he deemed the key question regarding "the five races of Blumenbach": "Is it proper to place them in the same rank, and allow them all the same zoological value?"[42(x,xi)] To this question, he said, there could only be one scientific answer: no. "Thus it has happened that these races, after having been once introduced into science by Blumenbach, have been retained there," he continued, predicting that "we may assert that they will always be retained, with some rectifications in their characteristics and in their several boundaries."[42(x,xi)]

This prophecy may yet be refuted, however; in 1996, the editors of the Council of Science proscribed use of *Caucasian* in scientific literature because it was "based on an outmoded theory of racial distinction."[10,43] The persistence of this term in current scientific literature, especially in works by leading medical geneticists who treat *race* as a "natural" category[44] much in the way that Blumenbach did,[33] thus serves as a telltale sign of either rank or willful ignorance, neither of which is promising for critical scientific thought.

LOGICAL AND BIOLOGICAL FALLACIES: CONSERVATIVE IDEOLOGY AND RACIALIZED TAUTOLOGIES

The unscientific and ideological underpinnings of contemporary work equating *race* with "innate" biology is likewise revealed by ways in which this literature tolerates or ignores the very types of logical fallacies that scientific theories are supposed to abhor. As explained by myriad texts on logic, philosophy, and science, there are numerous fallacies that can lead to false inferences on conceptual grounds alone—before the ideas are even empirically put to the test.[15,45–48]

One classic example, all too readily found in the literature on "racial" differences, involves tautology, a type of argument in which the conclusion simply restates the premises. This circular logic is evident whenever the claim is made that unobserved "innate" biological differences lead to observed biological differences—which in turn proves that unobserved "innate" biological differences exist. A literal textbook demonstration occurs in the following statement, appearing in a reference text published by a reputable scientific publisher: "Human beings are similar; they are of the same species, but belong to several different races; hence, they may differ in several important ways: in growth and development rates, in enzyme systems, in disease susceptibility, and in response to environmental stresses."[49(p2)] This tautological statement manages to ignore the extraordinarily well-known and well-documented fact,

equivalent to a textbook truism, that phenotype is not equivalent to genotype—precisely because observed traits are a function of gene expression and not simply gene frequency.[50–53] As any serious engagement with developmental biology would readily reveal, genetically identical organisms raised under markedly different conditions exhibit important differences in stature, appearance, and physiology.[50–53] To assume that phenotypic variation among humans is a function solely of inherited genes is an ideological, not scientific, argument.

Another fallacy, that of *argumentum ad numeram* (appealing to the numbers),[48(pp125–128)] recently starred in a lengthy Op-Ed piece in the *New York Times* as the first reason *race* should be rehabilitated as a biological variable, because doing so "would remove the disjunction in which the government and public alike defiantly embrace categories that many, perhaps most, scholars and scientists say do not exist."[54] By the same illogic, Galileo presumably should have ceded that the sun orbits the earth, and the more popular doctrine of creationism[55] should trump evolutionary biology as an explanation for biological variability.[56]

Most important, however, are formal logic fallacies involving logical asymmetries.[45–48] As noted by the geneticist Jeffrey C. Long, "While many marker alleles can be used to accurately infer ancestry, ancestry will allow only weak inference about whether an individual carries a particular allele."[57(p16)] At issue is the well-known fallacy of "affirming the consequent," which was described by Aristotle in the 4th century BCE; its formal statement is "if p, then q; q; p."[47(pp18–38)] Table 1, using the example of genetic polymorphisms affecting alcohol metabolism, illustrates this fallacy.[57] This invalid form of logic stands in stark contrast to 2 equally long-standing and well-known valid forms of argument, the "modus ponens," or "affirming the antecedent" ("if p, then q; p; q") and the "modus tellens," or "denying the consequent" ("if p, then q; not-q; not-p").[45(pp181–186),48(pp7,50)]

One recent instance of the "affirming the consequent" fallacy could serve as a textbook example—and indeed, it appears in an actual textbook. Without expressing any sense of contradiction, it states that "The characteristics that define a race will not define any specific individual from that race."[49(p5)] Equally pernicious are recent arguments in favor of the "racial profiling" of patients,[19–21,54,58] which endorse the practice of assigning a genetic profile based on observer-identified race/ethnicity, a stance that not only epitomizes the fallacious argument of "affirming the consequent" but could potentially incur medical harm.[5,8,9] It is a sign of profound ideological blinders that the self-proclaimed "biological realists"[19–21,54,58] evincing such views do not recognize either the illogic of their position or the empirical evidence to the contrary.

THE POLITICS OF TIME: "CLIMATE," "RACE," AND EMBODYING INEQUALITY

Still one more aspect of "climate" germane to the science and ideology of debates over *race*, genetics, and health disparities concerns the climate—literally. For millennia, extending back to ancient classical Greece[59] and China,[60,61] climate has been invoked and debated as an explanation for geographical diversity in human appearance.[28,34,35,40]

One underappreciated issue in the arguments over links between climate and *race* concerns what I would term the *politics of time*. As emphasized in recent scholarship, choice of time scale—often shaped by unconscious beliefs as well as by conscious design—can exert profound effects on scientific analysis.[15,62–64] This is because the framing of scientific questions depends heavily on assumptions, usually more implicit than explicit, regarding the appropriate time frame, level, and scale of analysis. Assume the heavens are fixed, or that the Earth was created several thousand years ago, or that biological types are permanent or "intelligently designed," and answers to questions about biological variability within and between species will differ starkly from ones premised on notions of biological evolution, whether gradual or punctuated.[28,53,55,65,66]

In the case of *race* and climate, theories on their links and their relationship to health, as propounded in both Europe and America, underwent a marked change between the mid-18th and mid-19th centuries. The initial presumption, premised on Hippocratic thought, was that observed differences in physical type and disease reflected the local influence of climate.[28,35,40,67,68] The implication was that if people moved to new locations, they should rapidly "acclimate" and become

TABLE 1—Example of Formal Logical Fallacies Regarding Race, Genetics, and Health

Type of Argument	Logical Example	Real-Life Example
Valid: "modus ponens"	1. Gene X is uniquely a marker of geographic ancestry Y ("if p, then q"). 2. Person A has gene X ("p"). 3. Therefore, Person A has geographic ancestry Y ("q").	Allele ALDH-2, affecting metabolism of alcohol, occurs only in Asian populations, such that its presence is a good marker of Asian ancestry. Nevertheless, the majority of Asians do not carry this allele, so knowing someone is Asian is not an indicator of genetic susceptibility to difficulties in metabolizing alcohol.[57(p16)] Hence, while inferring Asian ancestry on the basis of the presence of the allele ALDH-2 would be a valid inference ("modus ponens"), inferring that a person of Asian ancestry is, as such, genetically susceptible to difficulties in metabolizing alcohol would be an invalid inference ("affirming the consequent").
Invalid: "affirming the consequent"	1. Gene X is uniquely a marker of geographic ancestry Y ("if p, then q"). 2. Person A has geographic ancestry Y ("q"). 3. Therefore, Person A has gene X ("p").	

more like the indigenous inhabitants, in both appearance and morbidity. Over the course of a century, however, this assumption gave way to what Harrison has termed a "hardening" of racial categories.[67] Why? Because European colonizers and slavers in the Americas, South Asia, and Africa found that, contrary to their expectations, there remained considerable differences in the skin color and health status of the European "White" populations compared with both "natives" and slaves.[67–70]

Importantly, at this time, there was no knowledge about early-life acquisition of immunity, which is relevant to the observed differences in the susceptibility to yellow fever of newly imported African slaves, who probably acquired immunity in childhood, and British military conscripts to the Caribbean, who were newly exposed to the disease.[67,68] Nor was there knowledge of the influences of life course and intergenerational epigenetic influences on an individual's health.[71–73] In such a context, the era's political and racial "climates" supported the widespread embrace of the "fixity of type" hypothesis by slave owners, military commanders, and colonists, not to mention by most scientists as well.[67,68] Further favoring "fixed" notions was a conceptual temporal limitation: the vast amounts of time currently considered necessary to produce variation in human skin color would have been unthinkable in earlier eras. Contemporary research, for example, suggests the process required millennia, whereby among early *Homo sapiens* in equatorial Africa, genetic selection, acting in response to high levels of sunlight, favored furless and darker skin (probably for the regulation of both body temperature and the sunlight-induced synthesis of vitamin D); eventually, over thousands of years, selection favored lighter skin among members of the species who migrated away from the equator, thereby setting the basis for observed geographies of skin color.[74–76]

This question of the politics of time—and political climate—is equally relevant to contemporary analysis of persistent racial/ethnic disparities in health. One set of explanations, advanced in both the scientific literature and the popular press, has chiefly focused on current "gene-environment" interactions for genes of differing frequencies,[1–5,44,77,78] even as it is sometimes acknowledged that differences in gene expression, for genes of the same frequency, may also be germane.[1,2] What, however, constitutes "the environment," and what is the relevant time period? Here, the discussion remains extraordinarily vague. For example, throughout the special 2004 issue of *Nature-Genetics* on "Genetics for the Human Race,"[2] the determinants of racial/ethnic health disparities were characterized only as "genetic" and "non-genetic"—the latter being a category so expansive it could embrace everything from the cytoplasm to the cosmos. Yet, despite this potential scope, not 1 article in this issue,[56] when discussing "non-genetic" factors, cited any of the large and growing body of work on socioeconomic disparities in health within and across racial/ethnic groups and its relevance to understanding racial/ethnic disparities in health, let alone any of the current scientific research explicitly testing hypotheses on how racism harms health.[12,13,56,79–83]

Here, it is relevant to note that contemporary research on US racial attitudes indicates that upwards of 70% of White Americans believe racial discrimination is primarily a problem of the past, given passage of the Civil Rights Act and related legislation in the 1960s.[84–87] Suppose for a moment that this belief is true (despite substantial evidence indicating it is not[84–88]). Suppose also that past racial discrimination contributed to racial/ethnic disparities in health by a combination of pathways[79] involving economic deprivation, elevated exposure to hazardous living and working conditions, targeted marketing of harmful commodities, inadequate medical care, and chronic social trauma arising from experiences and threats of racial discrimination (all of which are hypotheses supported by an increasing body of evidence[12,13,79–83]). Would it be reasonable to posit that an absence of contemporary discrimination would be associated with an absence of racial/ethnic disparities in health? Absolutely not—because of the embodied impact of cumulative disadvantage across the life course and across generations.[71–73] Thus, although disparities in outcomes with a very short etiologic period (including those directly responsive to appropriate medical treatment) might decline rapidly, the myriad chronic diseases and other conditions with long etiologic periods, including intergenerational effects, would continue to exhibit persistent disparities reflecting prior inequities. Just as "climate" comprises the long-term average of the daily weather,[18] such that each must be reckoned on different time scales,[18,62] so too is population health a temporal composite and must be analyzed accordingly.[64,72]

The net implication is that at a time when the first generation of African Americans born in the post–Jim Crow Era is only 40 years old, it is probably not accidental that current life expectancy among African Americans resembles that of White Americans 40 years ago (Table 2).[89] At the same time, noteworthy secular improvements in health occurring within all racial/ethnic groups over the past century[89] underscore the importance of context and gene expression, not solely gene frequency, for population health.[12,52,56,72,90] The conservative claim that investigating the impact of discrimination on health is a diversion of scientific resources, in part because of post–Civil Rights Era declines in overt racism,[22,23,91] stands as telling testimony to conservatives' ideological manipulation of the politics of time.

TABLE 2—Temporal Lags in Life Expectancy for Black and White Populations: United States, 1900–2000

	Life Expectancy at Birth, y						
Group	1900	1950	1960	1970	1980	1990	2000
White[a]	47.6	69.1	70.6	71.7	74.4	76.1	77.6
Black[a]	33.0	60.8	63.6	64.1	68.2	69.1	71.4

Source. National Center for Health Statistics.[89]
[a]Data are reported only for Black and White comparisons because the US National Center for Health Statistics has national data on life expectancy at birth starting only in 1980 for the American Indian/Alaska Native and the Asian/Pacific Islander populations, and starting only in 1990 for the Hispanic population.

IDEOLOGY, "POLITICAL CLIMATES," AND THE SCIENCE OF HEALTH DISPARITIES

As should by now be evident, the *science* of health disparities requires rigorous thinking: logical, historical, sociological, and biological.[92] It is not a matter of mere opinion or ideology. In the case of racial/ethnic inequalities in health, the scientific challenge is to understand whether—and, if so, how—these disparities arise from the literal embodiment of unjust race relations. At issue are past and present histories of intertwined racial discrimination and economic deprivation and their implications for differential adverse exposures and regulation of gene expression.[12,29,56,72,79] Declaring such inquiry to be an unscientific "politically correct" exercise that squanders scarce research funds is disingenuous at best.[22,23,91] Indeed, evidence obtained from the National Institutes of Health (NIH) CRISP database[93] (a public access database providing information on all NIH grants awarded since 1975) suggests that researchers with an interest in genetics are unlikely to have their share of the NIH budget seriously encroached on by researchers with an interest in the impact of racial inequality on health. For the decade 1995 to 2004, use of the search term *genetics* in CRISP identified 21 956 new grants (including 181 additionally indexed by the term *race*). By contrast, only 44 new grants were indexed by the terms *racism* or *racial discrimination*, yielding a ratio of 500 to 1.

In conclusion, when considering the current stormy debates over *race*, genetics, and health disparities, it is critical to be conscious of continual conservative efforts to promote a "political climate" that favors individualistic explanations of population health and discounts concerns about social determinants of health disparities.[14,24–30,52,56,79–82] The loud objections emanating from the right-wing about current research demonstrating the impact of social inequality on health is occurring precisely because this new body of scientific work is making gains and is beginning to affect policy. Even at a time when conservative ideology has gained considerable political power in the United States, it is not inevitable that this political bloc will succeed in derailing efforts to address health disparities. Rather, as the current controversies over global climate change powerfully remind us[18,64,94]—not to mention the enduring spirit of Billie Holiday and Ella Fitzgerald, who sang not only of "stormy weather" but also of the possibilities for social change—"climate" is not an unalterable given but instead can be changed by human action. If conservative economic and political interests are threatened by research revealing how social injustice harms health, so be it—but their objections should not be confused with legitimate scientific critique. ■

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